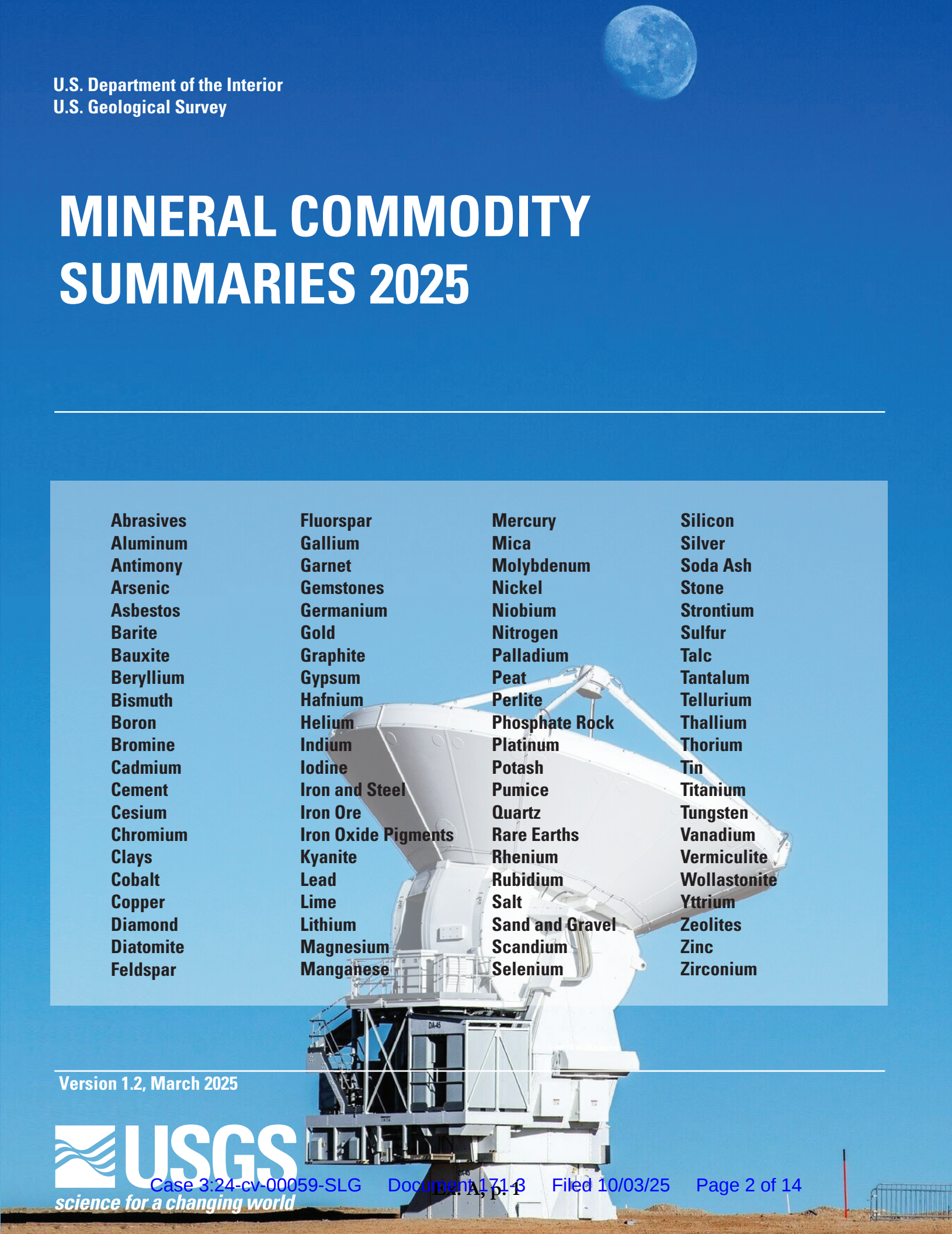
EXHIBIT A

U.S. Department of the Interior
U.S. Geological Survey

MINERAL COMMODITY SUMMARIES 2025



Version 1.2, March 2025

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Cover: Photograph of 1 of the 66 antennas that make up the Atacama Large Millimeter/submillimeter Array (ALMA) pointed at the moon. ALMA, which is operated by the European Southern Observatory (ESO), was constructed in 2013 and is located at an elevation of 5,000 meters on the Chajnantor Plateau in the Andes Mountains in Chile because of the location's low humidity and atmospheric interference. ALMA's dishes are not mirrors but have surfaces of metallic panels. The panels were constructed from materials such as aluminum (p. 32), carbon fiber reinforced polymer, and steel (p. 94). In addition, the receivers and motion-control devices contain many other mineral commodities. The long wavelengths that ALMA's antennas detect mean that the surfaces are accurate to within 25 micrometers—much less than the thickness of a sheet of paper. Not only are the dish surfaces carefully controlled, but the antennas can be steered precisely and pointed to an angular accuracy of 0.6 arcseconds (1 arcsecond is 1/3600 of a degree). This is accurate enough to detect a golf ball at a distance of 15 kilometers. Photograph by S. Otarola, ESO.

U.S. Department of the Interior
U.S. Geological Survey

MINERAL COMMODITY SUMMARIES 2025

Abrasives	Fluorspar	Mercury	Silicon
Aluminum	Gallium	Mica	Silver
Antimony	Garnet	Molybdenum	Soda Ash
Arsenic	Gemstones	Nickel	Stone
Asbestos	Germanium	Niobium	Strontium
Barite	Gold	Nitrogen	Sulfur
Bauxite	Graphite	Palladium	Talc
Beryllium	Gypsum	Peat	Tantalum
Bismuth	Hafnium	Perlite	Tellurium
Boron	Helium	Phosphate Rock	Thallium
Bromine	Indium	Platinum	Thorium
Cadmium	Iodine	Potash	Tin
Cement	Iron and Steel	Pumice	Titanium
Cesium	Iron Ore	Quartz	Tungsten
Chromium	Iron Oxide Pigments	Rare Earths	Vanadium
Clays	Kyanite	Rhenium	Vermiculite
Cobalt	Lead	Rubidium	Wollastonite
Copper	Lime	Salt	Yttrium
Diamond	Lithium	Sand and Gravel	Zeolites
Diatomite	Magnesium	Scandium	Zinc
Feldspar	Manganese	Selenium	Zirconium

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INSTANT INFORMATION

Information about the U.S. Geological Survey, its programs, staff, and products is available from the internet at https://www.usgs.gov or by calling (888) ASK–USGS [(888) 275–8747].

This publication has been prepared by the National Minerals Information Center (NMIC). Information about NMIC and its products is available from the internet at https://www.usgs.gov/centers/national-minerals-information-center or by writing to Director, National Minerals Information Center, 988 National Center, Reston, VA 20192.

KEY PUBLICATIONS

Minerals Yearbook—These annual publications review the mineral industries of the United States and of more than 180 other countries and localities. They contain statistical data on minerals and materials and include information on economic and technical trends and developments and are available at https://www.usgs.gov/centers/national-minerals-information-center/publications. The three volumes that make up the Minerals Yearbook are volume I, Metals and Minerals; volume II, Area Reports—Domestic; and volume III, Area Reports—International.

Mineral Commodity Summaries—Published on an annual basis, this report is the earliest Government publication to furnish estimates covering nonfuel mineral industry data and is available at https://www.usgs.gov/centers/national-minerals-information-center/mineral-commodity-summaries. Data sheets contain information on the domestic industry structure, Government programs, tariffs, world production and reserves, and 5-year salient statistics for more than 90 individual minerals and materials.

Mineral Industry Surveys—These periodic statistical and economic reports are designed to provide timely statistical data on production, shipments, stocks, and consumption of significant mineral commodities and are available at https://www.usgs.gov/centers/national-minerals-information-center/mineral-industry-surveys. The surveys are issued monthly, quarterly, or at other regular intervals.

Materials Flow Studies—These publications describe the flow of minerals and materials from extraction to ultimate disposition to help better understand the economy, manage the use of natural resources, and protect the environment and are available at https://www.usgs.gov/centers/national-minerals-information-center/materials-flow.

Recycling Reports—These studies illustrate the recycling of metal commodities and identify recycling trends and are available at https://www.usgs.gov/centers/national-minerals-information-center/recycling-statistics-and-information.

Historical Statistics for Mineral and Material Commodities in the United States (Data Series 140)—This report provides a compilation of statistics on production, trade, and use of approximately 90 mineral commodities since as far back as 1900 and is available at https://www.usgs.gov/centers/national-minerals-information-center/historical-statistics-mineral-and-material-commodities.

WHERE TO OBTAIN PUBLICATIONS

- *Mineral Commodity Summaries* and the *Minerals Yearbook* are sold by the U.S. Government Publishing Office. Orders are accepted over the internet at https://bookstore.gpo.gov, by email at ContactCenter@gpo.gov, by telephone toll free (866) 512–1800; Washington, DC, area (202) 512–1800, by fax (202) 512–2104, or through the mail (P.O. Box 979050, St. Louis, MO 63197–9000).

- All current and many past publications are available as downloadable Portable Document Format (PDF) files through https://www.usgs.gov/centers/national-minerals-information-center.

INTRODUCTION

Each mineral commodity chapter of the 2025 edition of the U.S. Geological Survey (USGS) Mineral Commodity Summaries (MCS) includes information on events, trends, and issues for each mineral commodity as well as discussions and tabular presentations on domestic industry structure, Government programs, tariffs, 5-year salient statistics, and world production, reserves, and resources. The MCS is the earliest comprehensive source of 2024 mineral production data for the world. More than 90 individual minerals and materials are covered by two-page synopses.

Abbreviations and units of measure and definitions of selected terms used in the report are in Appendix A and Appendix B, respectively. Reserves and resources information is in Appendix C, which includes “Part A—Resource and Reserve Classification for Minerals” and “Part B—Sources of Reserves Data.” A directory of USGS minerals information country specialists and their responsibilities is in Appendix D.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the MCS 2025 are welcomed.

COPPER

(Data in thousand metric tons, copper content, unless otherwise specified)

Domestic Production and Use: In 2024, the recoverable copper content of U.S. mine production was an estimated 1.1 million tons, a decrease of 3% from that in 2023, and was valued at an estimated $10 billion, slightly greater than $9.83 billion in 2023. Arizona was the leading copper-producing State and accounted for approximately 70% of domestic output; copper was also mined in Michigan, Missouri, Montana, Nevada, New Mexico, and Utah. Copper was recovered or processed at 25 mines (17 of which accounted for more than 99% of mine production), 2 primary smelters, 1 secondary smelter, 2 primary electrolytic refineries, 14 electrowon refineries, and 3 secondary fire refineries. A new secondary smelter and secondary refinery were expected to start up by yearend. Refined copper and scrap were consumed at about 30 brass mills, 14 rod mills, and several hundred foundries and miscellaneous manufacturers. According to the Copper Development Association, copper and copper alloy products were used in building construction, 42%; electrical and electronic products, 23%; transportation equipment, 18%; consumer and general products, 10%; and industrial machinery and equipment, 7%.

Salient Statistics—United States:	**2020**	**2021**	**2022**	**2023**	**2024[e]**
Production:					
Mine, recoverable	1,200	1,230	1,230	1,130	1,100
Refinery:					
Primary (from ore)	872	922	930	843	850
Secondary (from scrap)	43	49	40	39	40
Copper recovered from old (post-consumer) scrap[1]	161	169	152	[e]150	150
Imports for consumption:					
Ore and concentrates	2	11	12	3	([2])
Refined	676	919	732	771	810
Exports:					
Ore and concentrates	383	344	351	339	320
Refined	41	48	27	33	60
Consumption:					
Reported, refined copper	1,680	1,750	1,720	1,570	1,600
Apparent, primary refined copper and copper from old scrap[3]	1,660	1,960	1,820	1,690	1,800
Price, annual average, cents per pound:					
U.S. producer, cathode (COMEX + premium)	286.7	432.3	410.8	395.3	430
COMEX, high-grade, first position	279.9	424.3	400.7	385.7	420
London Metal Exchange, grade A, cash	279.8	422.5	399.8	384.8	420
Stocks, refined, held by U.S. producers, consumers, and metal exchanges, yearend	118	117	84	127	70
Employment, mine and plant, number	11,000	11,400	12,000	12,600	13,000
Net import reliance[4] as a percentage of apparent consumption	38	44	41	41	45

Recycling: Old (post-consumer) scrap, converted to refined metal, alloys, and other forms, provided an estimated 150,000 tons of copper in 2024, and an estimated 720,000 tons of copper was recovered from new (manufacturing) scrap derived from fabricating operations. Brass and wire-rod mills accounted for approximately 85% of the total copper recovered from scrap. Copper recovered from scrap contributed about 35% of the U.S. copper supply.[5]

Import Sources (2020–23): Copper content of blister and anodes: Finland, 92%; Malaysia, 3%; and other, 5%. Copper content of matte, ash, and precipitates: Canada, 48%; Belgium, 23%; Japan, 13%; Spain, 6%; and other, 10%. Copper content of ore and concentrates: Canada, >99%; and other, <1%. Copper content of scrap: Canada, 46%; Mexico, 42%; Dominican Republic, 3%; and other, 9%. Refined copper: Chile, 65%; Canada, 17%; Mexico, 9%; Peru, 6%; and other, 3%. Refined copper accounted for 88% of all unmanufactured copper imports.

Tariff: **Item**	**Number**	**Normal Trade Relations 12–31–24**
Copper ore and concentrates, copper content	2603.00.0010	1.7¢/kg on lead content.
Unrefined copper anodes	7402.00.0000	Free.
Refined copper and alloys, unwrought	7403.00.0000	1% ad valorem.
Copper scrap	7404.00.0000	Free.
Copper wire rod	7408.11.0000	1% or 3% ad valorem.

Depletion Allowance: 15% (domestic), 14% (foreign).

Government Stockpile: None.

Prepared by **Daniel M. Flanagan [(703) 648–7726, dflanagan@usgs.gov]**

COPPER

Events, Trends, and Issues: In 2024, production decreased at a majority of copper mines in the United States, and domestic mined copper output declined by an estimated 3% from that in 2023. At the Bingham Canyon Mine in Utah, changes to the mine plan required to mitigate geotechnical risks resulted in lower ore grades and copper recoveries. Production at the Eagle Mine in Michigan was affected by decreased copper ore grades and reduced mill throughput rates owing to a fall of ground along an ore access ramp. Output also decreased at multiple mines in Arizona and New Mexico because of lower ore grades and mining rates. These decreases were partially offset by a significant increase in mined copper production at the Robinson Mine in Nevada owing to planned mine sequencing that yielded higher ore grades and copper recovery rates. At U.S. refineries, copper production increased slightly in 2024 compared with that in 2023. The Kennecott smelter and electrolytic refinery near Salt Lake City, UT, returned to normal operations in the first quarter of 2024 following major rebuilds in 2023. A new secondary copper refinery in Kentucky and a new secondary copper smelter in Georgia were expected to begin operating by yearend 2024.

The COMEX copper price reached a record high in May 2024 and was projected to average $4.20 per pound in full year 2024, an increase of 9% from the annual average price in 2023. Analysts attributed the higher price to multiple factors, such as expectations for reduced global copper supply in the near future, optimistic sentiment regarding world copper demand, strong manufacturing production in China, and decreasing inflation in the United States.

World Mine and Refinery Production and Reserves: Reserves for Canada, Indonesia, Peru, and the United States were revised based on company, Government, and (or) industry association reports.

	Mine production		Refinery production		Reserves[6]
	2023	2024[e]	2023	2024[e]	
United States	1,130	1,100	882	890	47,000
Australia	778	800	442	460	[7]100,000
Canada	500	450	315	320	8,300
Chile	5,250	5,300	2,080	1,900	190,000
China	1,820	1,800	12,000	12,000	41,000
Congo (Kinshasa)	2,930	3,300	2,170	2,500	80,000
Germany	—	—	609	630	—
India	27	30	509	510	2,200
Indonesia	907	1,100	225	350	21,000
Japan	—	—	1,490	1,600	—
Kazakhstan	[e]740	740	458	470	20,000
Korea, Republic of	—	—	604	620	—
Mexico	699	700	509	350	53,000
Peru	2,760	2,600	403	390	100,000
Poland	395	410	592	590	34,000
Russia	[e]890	930	[e]1,000	960	80,000
Zambia	712	680	222	170	21,000
Other countries	3,020	2,700	2,460	2,500	180,000
World total (rounded)	22,600	23,000	27,000	27,000	980,000

World Resources:[6] The most recent U.S. Geological Survey assessment of global copper resources indicated that, as of 2015, identified resources contained 1.5 billion tons of unextracted copper (2.1 billion tons when past production of 0.6 billion tons is included) and undiscovered resources contained an estimated 3.5 billion tons of copper.[8]

Substitutes: Aluminum substitutes for copper in automobile radiators, cooling and refrigeration tube, electrical equipment, and power cable. Optical fiber substitutes for copper in telecommunications applications, and plastics substitute for copper in drain pipe, plumbing fixtures, and water pipe. Titanium and steel are used in heat exchangers.

[e]Estimated. — Zero.

[1]Copper converted to refined metal, alloys, and other forms by brass and wire-rod mills, foundries, refineries, and other manufacturers.

[2]Less than ½ unit.

[3]Primary refined production + copper recovered from old scrap + refined imports – refined exports ± adjustments for refined copper stock changes.

[4]Defined as refined imports – refined exports ± adjustments for refined copper stock changes.

[5]Primary refined production + copper from old and new scrap + refined imports – refined exports ± adjustments for refined copper stock changes.

[6]See Appendix C for resource and reserve definitions and information concerning data sources.

[7]For Australia, Joint Ore Reserves Committee-compliant or equivalent reserves were 27 million tons.

[8]Source: Hammarstrom, J.M., Zientek, M.L., Parks, H.L., Dicken, C.L., and the U.S. Geological Survey Global Copper Mineral Resource Assessment Team, 2019, Assessment of undiscovered copper resources of the world, 2015 (ver. 1.2, December 2021): U.S. Geological Survey Scientific Investigations Report 2018–5160, 619 p. (Accessed November 18, 2024, at https://doi.org/10.3133/sir20185160.)

MOLYBDENUM

(Data in metric tons, molybdenum content, unless otherwise specified)

Domestic Production and Use: Total estimated U.S. mine production of molybdenum concentrate decreased by 3% to 33,000 tons of molybdenum content in 2024 compared with 34,000 tons in 2023. Molybdenum concentrate production at primary molybdenum mines continued at two operations in Colorado, and molybdenum concentrate production from mines where molybdenum was a byproduct continued at seven operations (four in Arizona and one each in Montana, Nevada, and Utah). Three roasting plants converted molybdenum concentrate to molybdic oxide, from which intermediate products, such as ferromolybdenum, metal powder, and various chemicals, were produced. Molybdenum is a refractory metallic element used principally as an alloying agent in cast iron, steel, and superalloys and is also used in numerous chemical applications, including catalysts, lubricants, and pigments.

Salient Statistics—United States:	2020	2021	2022	2023	2024[e]
Production, mine	51,100	41,100	34,600	34,000	33,000
Imports for consumption total:					
Ore and concentrates	15,100	15,500	15,700	16,200	16,000
Primary products	9,570	14,700	13,100	13,500	13,000
Exports:					
Ore and concentrates	59,500	55,800	46,200	49,000	45,000
Primary products	3,110	4,150	4,860	4,230	5,500
Consumption:					
Reported[1]	15,800	16,100	15,800	[e]16,000	16,000
Apparent[2]	13,100	11,200	12,300	10,900	12,000
Price, average, dollars per kilogram[3]	19.19	35.62	41.72	54.32	47
Stocks, consumer materials	2,010	2,040	2,040	[e]1,900	1,800
Net import reliance[4] as a percentage of apparent consumption	E	E	E	E	E

Recycling: Molybdenum is recycled as a component of catalysts, ferrous scrap, and superalloy scrap. Ferrous scrap consists of revert, new, and old scrap. Revert scrap refers to remnants manufactured in the steelmaking process. New scrap is generated by steel mill customers and recycled by scrap collectors and processors. Old scrap is largely molybdenum-bearing alloys recycled after serving their useful life. The amount of molybdenum recycled as part of new and old steel and other scrap may be as much as 30% of the apparent supply of molybdenum. There are no processes for the separate recovery and refining of secondary molybdenum from its alloys, but the molybdenum content of the recycled alloys is significant and is reused.

Import Sources (2020–23): Ferromolybdenum: Chile, 77%; Republic of Korea, 19%; United Kingdom, 3%; and other, 1%. Molybdenum ore and concentrates: Peru, 64%; Mexico, 18%; Chile, 12%; Canada, 5%; and other, 1%. Total: Peru, 35%; Chile, 34%; Mexico, 10%; Republic of Korea, 6%; and other, 15%.

Tariff: Item	Number	Normal Trade Relations 12–31–24
Molybdenum ore and concentrates, roasted	2613.10.0000	12.8¢/kg on molybdenum content + 1.8% ad valorem.
Molybdenum ore and concentrates, other	2613.90.0000	17.8¢/kg on molybdenum content.
Molybdenum chemicals:		
Molybdenum oxides and hydroxides	2825.70.0000	3.2% ad valorem.
Molybdates of ammonium	2841.70.1000	4.3% ad valorem.
Molybdates, all others	2841.70.5000	3.7% ad valorem.
Molybdenum pigments, molybdenum orange	3206.20.0020	3.7% ad valorem.
Ferroalloys, ferromolybdenum	7202.70.0000	4.5% ad valorem.
Molybdenum metals:		
Powders	8102.10.0000	9.1¢/kg on molybdenum content + 1.2% ad valorem.
Unwrought	8102.94.0000	13.9¢/kg on molybdenum content + 1.9% ad valorem.
Wrought bars and rods	8102.95.3000	6.6% ad valorem.
Wrought plates, sheets, strips, and so forth	8102.95.6000	6.6% ad valorem.
Wire	8102.96.0000	4.4% ad valorem.
Waste and scrap	8102.97.0000	Free.
Other	8102.99.0000	3.7% ad valorem.

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MOLYBDENUM

Depletion Allowance: 22% (domestic), 14% (foreign).

Government Stockpile: None.

Events, Trends, and Issues: In 2024, the estimated average U.S. molybdic oxide price decreased by 13% compared with that in 2023. Estimated U.S. total imports for consumption of molybdenum decreased slightly compared with those in 2023. Estimated U.S. total exports decreased by 5% compared with those in 2023. Estimated apparent consumption in 2023 increased by 11% compared with that in 2023. In 2024, a Canadian company announced plans to restart its idled Idaho molybdenum mine in the second half of 2027 as well as a progressive rampup to full capacity production at its molybdenum-processing facility in Pennsylvania. Estimated global molybdenum production in 2024 increased by 6% compared with that in 2023. In descending order of production, China, Peru, Chile, the United States, and Mexico provided 90% of total global production. Of the five major producers, only China and the United States produced molybdenum from both primary molybdenum mines and byproduct copper mines; the other countries produced molybdenum as a byproduct from copper mines. Declining ore grades at porphyry copper mines continued to affect molybdenum production. Several large porphyry copper mines are expected to reach end-of-life in the mid-2030s which will further affect future molybdenum supply. Molybdenum was expected to continue to have strong demand in global power generation and infrastructure projects as countries continue to prioritize clean energy to address climate change.

World Mine Production and Reserves: Reserves data for Canada, China, Mongolia, and Peru were revised based on company and Government reports.

	Mine production		Reserves[5]
	2023	2024[e]	(thousand metric tons)
United States	34,000	33,000	3,500
Argentina	—	—	100
Armenia	[e]7,600	8,000	150
Australia	660	1,000	[6]690
Canada	1,150	1,200	64
Chile	44,100	38,000	1,400
China	[e]96,000	110,000	5,900
Iran	[e]2,500	3,000	43
Kazakhstan	3,730	3,900	7
Korea, North	[e]400	700	NA
Korea, Republic of	339	300	8
Mexico	17,500	17,000	130
Mongolia	3,160	3,100	10
Peru	33,500	41,000	1,900
Russia	[e]1,700	1,700	1,100
Uzbekistan	[e]1,700	1,700	21
World total (rounded)	248,000	260,000	15,000

World Resources:[5] Identified resources of molybdenum in the United States are about 5.4 million tons and, in the rest of the world, about 20 million tons. Molybdenum occurs as the principal metal sulfide in large low-grade porphyry molybdenum deposits and as an associated metal sulfide in low-grade porphyry copper deposits. Resources of molybdenum are adequate to supply world needs for the foreseeable future.

Substitutes: There is little substitution for molybdenum in its major application in steels and cast irons. In fact, because of the availability and versatility of molybdenum, industry has sought to develop new materials that benefit from its alloying properties. Potential substitutes include boron, chromium, niobium (columbium), and vanadium in alloy steels; tungsten in tool steels; graphite, tantalum, and tungsten for refractory materials in high-temperature electric furnaces; and cadmium-red, chrome-orange, and organic-orange pigments for molybdenum orange.

[e]Estimated. E Net exporter. NA Not available. — Zero.

[1]Reported consumption of primary products.

[2]Defined as production + imports – exports ± adjustments for all industry stock changes.

[3]U.S. molybdic oxide (MoO_3) price, 57% molybdenum content. Source: Argus Media Group, Argus Non-Ferrous Markets.

[4]Defined as imports – exports ± adjustments for industry stock changes.

[5]See Appendix C for resource and reserve definitions and information concerning data sources.

[6]For Australia, Joint Ore Reserves Committee-compliant or equivalent reserves were 250,000 tons.

RHENIUM

(Data in kilograms, rhenium content, unless otherwise specified)

Domestic Production and Use: During 2024, rhenium-containing products including ammonium perrhenate (APR), metal powder, and perrhenic acid were produced as byproducts from roasting molybdenum concentrates from porphyry copper-molybdenum deposits in Arizona and Montana. Total estimated U.S. primary production was approximately 9,500 kilograms in 2024, compared with 9,410 kilograms in 2023. The United States continued to be a leading producer of secondary rhenium, recovering rhenium from nickel-base superalloy scrap, spent oil-refining catalysts, and foundry revert. The major uses of rhenium were in superalloys used in high-temperature turbine engine components and in petroleum-reforming catalysts, representing an estimated 80% and 15%, respectively, of end uses. Bimetallic platinum-rhenium catalysts were used in petroleum reforming to produce high-octane hydrocarbons, which are used in the production of lead-free gasoline. Rhenium improves the high-temperature (>1,000 degrees Celsius) strength properties of some nickel-base superalloys. Rhenium alloys were used in crucibles, electrical contacts, electromagnets, electron tubes and targets, heating elements, ionization gauges, mass spectrographs, metallic coatings, semiconductors, temperature controls, thermocouples, vacuum tubes, and other applications.

Salient Statistics—United States:	2020	2021	2022	2023	2024[e]
Production[1]	8,830	9,290	8,870	9,410	9,500
Imports for consumption					
Rhenium, unwrought and powders[2]	15,900	15,900	11,900	10,200	13,000
Ammonium perrhenate[3]	9,320	6,020	8,810	4,890	6,900
Exports	—	—	267	2,010	2,200
Consumption, apparent[4]	34,000	31,200	29,400	22,500	27,000
Price, average value, gross weight, dollars per kilogram:[5]					
Metal pellets, 99.99% pure	1,030	977	1,120	1,070	1,370
Ammonium perrhenate	1,090	866	911	920	1,270
Employment, number	Small	Small	Small	Small	Small
Net import reliance[6] as a percentage of apparent consumption	74	70	70	58	65

Recycling: Nickel-base superalloy scrap and scrapped turbine blades and vanes continued to be recycled hydrometallurgically to produce rhenium metal for use in new superalloy melts. The scrapped parts also were processed to generate engine revert—a high-quality, lower cost superalloy meltstock—by an increasing number of companies, mainly in Canada, Estonia, France, Germany, Japan, Poland, Russia, and the United States. Rhenium-containing catalysts also were recycled. The rhenium recycled from spent catalysts was either returned to the oil companies or to the catalyst producer for production of new catalysts in what is considered a closed-loop system.

Import Sources (2020–23): Ammonium perrhenate: Kazakhstan, 26%; Canada, 24%; Poland, 15%; and other, 35%. Rhenium metal powder: Chile, 62%; Germany, 15%; Canada, 12%; Poland, 7%; and other, 4%. Total imports: Chile, 44%; Canada, 16%; Germany, 13%; Poland, 10%; and other, 17%.

Tariff: Item	Number	Normal Trade Relations 12–31–24
Salts of peroxometallic acids, other, ammonium perrhenate	2841.90.2000	3.1% ad valorem.
Rhenium, unwrought, waste and scrap	8112.41.1000	Free.
Rhenium, unwrought, powders	8112.41.5000	3% ad valorem.
Rhenium, other	8112.49.0000	4% ad valorem.
Rhenium (and other metals), wrought	8112.99.9100	4% ad valorem.

Depletion Allowance: 14% (domestic and foreign).

Government Stockpile: None.

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RHENIUM

Events, Trends, and Issues: In 2024, the estimated price for catalytic-grade APR averaged $1,270 per kilogram, 38% more than the annual average price of $920 per kilogram in 2023. The estimated rhenium metal pellet price averaged $1,370 per kilogram in 2024, a 28% increase from the annual average price of $1,070 per kilogram in 2023.

In 2024, apparent consumption in the United States was about 20% more than that in 2023. During 2024, the United States continued to rely on imports for much of its supply of rhenium. Canada, Chile, Germany, Kazakhstan, and Poland supplied most of the imported rhenium. Imports of APR increased by an estimated 41% in 2024 compared with those in 2023. Imports of rhenium metal increased by an estimated 25% in 2024 compared with those in 2023. Estimated world rhenium production in 2024 was 62,000 kilograms compared with 62,600 kilograms in 2023.

The United States and Germany continued to be the leading secondary rhenium producers. Secondary rhenium production also took place in Canada, Estonia, France, Japan, Poland, and Russia. Available information was insufficient to make U.S. secondary production estimates; however, industry sources estimated that U.S. capacity was between 18,000 and 20,000 kilograms per year of rhenium. Industry sources estimated that approximately 25,000 kilograms of secondary rhenium was produced worldwide in 2024.

World Mine Production and Reserves:

	Mine production[e, 7]		Reserves[8]
	2023	2024	
United States	9,410	9,500	400,000
Armenia	210	200	95,000
Chile[9]	30,000	29,000	1,300,000
China	5,300	5,300	19,000
Kazakhstan	500	500	190,000
Korea, Republic of	2,800	3,000	NA
Poland	9,380	9,400	NA
Russia	NA	NA	310,000
Uzbekistan	5,000	5,000	NA
World total (rounded)	62,600	62,000	Large

World Resources:[8] Most rhenium occurs with molybdenum in porphyry copper deposits. Identified U.S. resources are estimated to be about 7 million kilograms. Rhenium also is associated with copper minerals in sedimentary deposits in Armenia, Kazakhstan, Poland, Russia, and Uzbekistan, where ore is processed for copper recovery and the rhenium-bearing residues are recovered at copper smelters.

Substitutes: Substitutes for rhenium in platinum-rhenium catalysts are continually being evaluated; one such application using iridium and tin has achieved commercial success. Other metals being evaluated for catalytic use include gallium, germanium, indium, selenium, silicon, tungsten, and vanadium. The use of these and other metals in bimetallic catalysts might decrease rhenium's share of the existing catalyst market; however, this would likely be offset by rhenium-bearing catalysts being considered for use in several proposed gas-to-liquid projects. Materials that can substitute for rhenium in various end uses are as follows: cobalt and tungsten for coatings on copper X-ray targets, rhodium and rhodium-iridium for high-temperature thermocouples, tungsten and platinum-ruthenium for coatings on electrical contacts, and tungsten and tantalum for electron emitters.

[e]Estimated. NA Not available. — Zero.
[1]Based on 80% recovery of estimated rhenium contained in molybdenum disulfide concentrates. Secondary rhenium production not included.
[2]Includes data for the following Harmonized Tariff Schedule of the United States (HTS) codes: 8112.92.5000 (2020–21) and 8112.41.5000 and 8112.49.0000 (2022–24). Does not include wrought forms or waste and scrap.
[3]The rhenium content of ammonium perrhenate is 69.42%.
[4]Defined as production + imports – exports.
[5]Average price per kilogram of rhenium in pellets or catalytic-grade ammonium perrhenate. Source: Argus Media Group, Argus Non-Ferrous Markets.
[6]Defined as imports – exports.
[7]Estimated amount of rhenium recovered in association with copper and molybdenum production. Secondary rhenium production not included.
[8]See Appendix C for resource and reserve definitions and information concerning data sources.
[9]Estimated rhenium recovered from roaster residues from Belgium, Chile, Mexico, and Peru.